THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Masahiro SASAGAWA et al.

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For : MODIFIED HYDROGENATED COPOLYMER

Art Unit : 1713

Examiner : Rábago, Roberto

DECLARATION

I, Masahiro Fujiwara, a Japanese citizen residing at Iris Neo 1005, 17-1, Minamisaiwaicho 2-chome, Saiwai-ku, Kawasaki-shi, Kanagawa-ken, Japan, declare and say:

I was graduated from the Department of Chemistry, Faculty of Science, Osaka University, Japan, in March 1986.

I took a master course in the Graduate School of Science, Faculty of Science, Osaka University in April 1986, and I was graduated therefrom in March 1988.

I entered Asahi Kasei Kogyo Kabushiki Kaisha in April 1988. I have been engaged in the research and development of various types of synthetic rubbers and engaged in the devel-

opment of applications of synthetic rubbers, from April 1988 to date.

I have read and understood the Office Action dated December 1, 2006 issued in the present case and the reference cited therein.

I have made comparative experiments to show the **criticality** of characteristics (1) and (2) recited in claim 1 of the present application for achieving excellent properties with respect to abrasion resistance and flexibility. The method and results are as described in a paper attached hereto and marked "Exhibit 1".

From the results, the following can be fairly concluded:

(I) As seen from Table B of Exhibit 1, **Polymer 1** (which satisfies both of characteristics (1) and (2) recited in claim 1 of the present application) has **excellent** properties with respect to both of **abrasion resistance** and **flexibility**. More specifically, with respect to **Polymer 1**, it was found that the decrease in volume after the abrasion test was as low as **0.011 ml** (evaluation symbol: ○ , i.e., excellent abrasion resistance), and the 100 % modulus was as low as **39 %** (i.e., excellent flexibility).

(II) By contrast, as seen from Table B of Exhibit 1, **Comparative Polymers 1 to 3** (each of which does not satisfy one of characteristics (1) and (2) recited in claim 1 of the present application) have **poor** abrasion resistance or **poor** flexibility, as compared to the properties of Polymer 1.

(III-i) Thus, the instant comparative experiments show that, only when characteristics (1) and (2) recited in claim 1 of the present application are satisfied, there can be exhibited excellent properties with respect to both of abrasion resistance and flexibility.

(III-ii) From the above, it is apparent that characteristics (1) and (2) recited in claim 1 of the present application are **critical** for achieving excellent properties with respect to both of abrasion resistance and flexibility.

The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such

willful false statements may jeopardize the validity of the application or any patent issuing thereon.

February 16, 2007
Date

MASAHIRO FUJIWARA
Masahiro FUJIWARA

Exhibit 1

Comparative experiments to show the **criticality** of characteristics (1) and (2) recited in claim 1 of the present application for achieving excellent properties with respect to abrasion resistance and flexibility

1. Object of the experiments

The present invention is directed to a modified hydrogenated copolymer comprising a hydrogenated copolymer and a functional group-containing modifier group bonded to the hydrogenated copolymer, the modified hydrogenated copolymer having the following characteristics (1) to (4):

(1) a content of the vinyl aromatic monomer units of from more than 60 % by weight to less than 90 % by weight, based on the weight of the hydrogenated copolymer,

(2) a content of the vinyl aromatic polymer block (H) (vinyl aromatic homopolymer block) of from 0.1 to 40 % by weight, based on the weight of the unhydrogenated copolymer,

(3) a weight average molecular weight of from more than 100,000 to 1,000,000, and

(4) a hydrogenation ratio of 70 % or more, as measured with respect to the double bonds in the conjugated diene monomer units.

In the present invention, the above-mentioned characteristics (1) and (2) are **critical** for achieving excellent properties with respect to both of abrasion resistance and flexibility.

In order to substantiate this contention, experiments were conducted as follows.

2. Methods and Materials

In the experiments, the following Polymer 1 and Comparative Polymers 1 to 3 were provided and used.

Table A

	Styrene content (wt%) *(characteristic (1))*	Polystyrene block (B) content (wt%) *(characteristic (2))*	Vinyl bond content (mol%)	Weight average molecular weight (Mw)	Molecular weight distribution (Mw/Mn)	Modification		Hydrogenation ratio (%)
						Modifier**	Modification ratio (%)	
Polymer 1*	67	20	14	200,000	1.9	M1	80	99
Comparative Polymer 1	67	45	14	210,000	1.9	M1	80	99
Comparative Polymer 2	55	8	14	200,000	1.9	M1	80	99
Comparative Polymer 3	91	39	14	193,000	1.9	M1	80	99

Notes: * Polymer 1 is the polymer used in Example 1 of the present application

** M1: 1,3-dimethyl-2-imidazolidinone

As shown in Table A above, **Polymer 1** (present invention) **satisfies** all requirements (including characteristics (1) and (2)) of claim 1 of the present application.

As also shown in Table A above, each of **Comparative Polymers 1 to 3** does **not** satisfy one of characteristics (1) and (2) of claim 1 of the present application.

Experiment 1 (Measurement of abrasion resistance)

The abrasion resistance of each of Polymer 1 and Comparative Polymers 1 and 2 was evaluated in accordance with the method described at page 165, lines 4 to 18 of the present English specification. For easier reference, the description at page 165, lines 3 to 18 of the present English specification is quoted below:

> I-11) Abrasion resistance:
>
> Using a Color Fastness Rubbing Tester (trade name: AB-301; manufactured and sold by TESTER SANGYO CO., LTD., Japan), the leather grained surface of a sheet obtained by molding the modified or unmodified hydrogenated copolymer was abraded 10,000 times with an abrading cloth (canequim No. 3) under a load of 500 g. The decrease in volume of the sheet, which was caused by the 10,000 times abrasion of the sheet, was measured, and used as a yardstick for the abrasion resistance of the modified or unmodified hydrogenated copolymer. Spe-

cifically, the abrasion resistance of the modified or unmodified hydrogenated copolymer was evaluated by the following criteria:

	Decrease in volume of the sheet, which is caused by the 10,000 times abrasion of the sheet
◎	0.01 ml or less
○	From more than 0.01 ml to 0.05 ml
△	From more than 0.05 ml to 0.10 ml
×	More than 0.10 ml

(Emphasis added)

Experiment 2 (Measurement of flexibility)

The flexibility of each of Polymer 1 and Comparative Polymer 3 was evaluated in accordance with the method described at page 164, line 8 to page 165, line 1 of the present English specification. For easier reference, the description at page 164, line 8 to page 165, line 1 of the present English specification is quoted below:

I-10) Flexibility:

The 100 % modulus was used as an index for flexibility. The tensile property of a compression-molded specimen of the modified or unmodified hydrogenated copolymer was measured in accordance with JIS K 6251 to obtain the stress sustained by the specimen when the specimen was stretched by 100 % (hereinafter, this stress value is referred to as the "100 % modulus" of the modified or un-

modified hydrogenated copolymer). The smaller the 100 % modulus of the modified or unmodified hydrogenated copolymer, the better the flexibility of the modified or unmodified hydrogenated copolymer. It is preferred that the 100 % modulus of the modified or unmodified hydrogenated copolymer is 120 **kg/cm^2 or less**.
(Emphasis added)

3. Results

The results of Experiments 1 and 2 are shown in Table 5 below.

Table B

	Abrasion resistance		Flexibility *
	Decrease in volume (ml)	Evaluation	100% modulus (kg/cm^2)
Polymer 1	0.011	○	39
Comparative Polymer 1	0.18	×	-
Comparative Polymer 2	0.08	Δ	-
Comparative Polymer 3	-	-	320

Note: * The **smaller** the 100 % modulus, the **better** the flexibility

As can be seen from Table B above, **Polymer 1** (which satisfies both of characteristics (1) and (2) recited in claim 1 of the present application) has **excellent** properties with respect to both of **abrasion resistance** and **flexibility**. More specifically, with respect to **Polymer 1**, it was found that the decrease in volume after the abrasion test was as low as **0.011 ml** (evaluation symbol: ○ , i.e., excellent abrasion resistance), and the 100 % modulus was as low as **39 %** (i.e., excellent flexibility).

By contrast, as can be seen from Table B, **Comparative Polymers 1 to 3** (each of which does not satisfy one of characteristics (1) and (2) recited in claim 1 of the present application) have **poor** abrasion resistance or **poor** flexibility.

More specifically, with respect to **Comparative Polymer 1**

(which does not satisfy the upper limit requirement of characteristic (2)), it was found that the decrease in volume after the abrasion test was (disadvantageously) as high as 0.18 ml (vs. as low as 0.011 ml in the case of Polymer 1) (i.e., **Comparative Polymer 1** has poor abrasion resistance).

With respect to **Comparative Polymer 2** (which does not satisfy the lower limit requirement of characteristic (1)), it was found that the decrease in volume after the abrasion test was (disadvantageously) as high as 0.08 ml (vs. as low as 0.011 ml in the case of Polymer 1) (i.e., **Comparative Polymer 2** has poor abrasion resistance).

With respect to **Comparative Polymer 3** (which does not satisfy the upper limit requirement of characteristic (1)), it was found that the 100 % modulus was (disadvantageously) as high as 320 % (vs. as low as 39 % in the case of Polymer 1) (i.e., **Comparative Polymer 3** has poor flexibility).

4. Conclusion

Thus, the instant comparative experiments show that, only when characteristics (1) and (2) recited in claim 1 of the present application are satisfied, there can be exhibited excellent properties with respect to both of abrasion resistance and flexibility.

From the above, it is apparent that characteristics (1) and (2) recited in claim 1 of the present application are **critical** for achieving excellent properties with respect to both of abrasion resistance and flexibility.